Behavior Analysis & Technology, Inc.

2020 EPA Presentation

Assessing Attention in Children and Adolescents with Developmental Disabilities In-Office and Online

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Behavior Analysis & Technology, Inc.

Presentation for the 2020 Annual Meeting of the Eastern Psychological Association, Boston, MA

Discovering manipulations that affect how children attend to complex stimuli is important because of the presence of attentional deficits that many children possess which interfere with their learning and development. One attentional impairment that can interfere with a child's development is overselective attention. Overselective attention occurs when a child demonstrates restricted attention because the child attends to only a limited number of stimulus elements in compound stimuli. Overselective attention is common among individuals with developmental disabilities and has also been reported in young children of typical development.

Establishing prior reinforcement histories for separate stimulus components was examined in this study, using a software-administered procedure, to determine if they controlled which features of compound visual cues young children of typical development and adolescents with developmental disabilities attended to. In most

instances, the response topographies and test performance of three young children indicated that they selectively attended to only symbols with an unchanged prior reinforcement history in the stimulus compounds when criterion accuracy was achieved. Symbols with a reversed prior reinforcement history in the compounds were usually ignored. This was shown as on most reinforced trials when criterion accuracy was met, the young children touched only unchanged symbols in the conflict compounds. In addition, in the majority of test sessions, only the unchanged-symbol pair exercised stimulus control in agreement with the reinforcement contingencies of the conflict compound. The children differed, however, in how quickly they shifted their attention to unchanged symbols.

The adolescents with intellectual disabilities also eventually learned to selectively attend to unchanged symbols in the conflict compounds. In contrast to the young children of typical development, however, the adolescents required extended training before they attended to the unchanged symbols. Longer single-stimulus pretraining and additional exposure to the conflict compounds were required before the adolescents shifted their attention among stimulus elements in accordance with prior reinforcement histories. Two of the three adolescents with intellectual disabilities failed to originally shift their attention to unchanged symbols because of overselective attention. Both adolescents responded to the same symbol pair in all three conflict-compounds regardless of whether the prior reinforcement histories of the symbol pair were unchanged or reversed in the compound. After additional training was provided, however, their overselective attention was eliminated. The two adolescents now selectively attended to the unchanged symbols regardless of which positions they occupied in the three conflict-compounds following extended training. Stimulus overselectivity in this investigation was not an unmodifiable perceptual characteristic.

In addition, administering the stimulus-control procedures online at remote sites where the author was not present also proved to be effective in assessing how the participants, who differed in age, attended to a stimulus compound with conflicting prior reinforcement histories. By employing multiple testing procedures, which were automatically administered by the software, individual differences were also revealed in how four participants attended to the conflict compound. The response topographies and test performance of two of the three older participants revealed they selectively

attended to the unchanged symbol in the conflict compound when criterion accuracy was achieved. Both older participants shifted their attention to the unchanged symbol with only a few errors occurring.

The third older participant, however, had opposing response topographies and test results. Although she responded to both the unchanged symbol and reversed symbols in the conflict compound when criterion accuracy was achieved, her test performance indicated that she selectively attended to the unchanged symbol. Finally, neither the response topographies nor the test performance of the young child participant demonstrated that he selectively attended to the unchanged symbol when he originally achieved criterion accuracy. After extended training was provided, however, both his response topographies and test performance revealed he shifted his attention to the unchanged symbol in the conflict compound with only a few errors occurring.

Despite individual differences, manipulating prior reinforcement histories of individual stimuli was effective in controlling how the participants attended to a stimulus compound even when the procedures were provided online at remote sites. In contrast to the earlier phases of this study, this also occurred with laptop computers, where touch screens were not utilized, and where social and monetary reinforcement were not provided. Administering the stimulus-control procedures and automatically analyzing the results online eliminated the need for sophisticated computer equipment or an expertise in discrimination learning to carry out the described procedures. By automatically generating a report following the session, the participants also received immediate feedback concerning their performance.

Recording response topographies, in addition to response accuracy, in this series of investigations provided a more sensitive and fine-grain analysis of individual differences in how stimulus compounds were attended to. By recording response topographies, it was also possible to determine how quickly the subjects shifted their attention, when stimulus compounds were presented, in accordance with prior reinforcement histories. Adolescents with developmental disabilities were found to have greater difficulty initially in shifting their attention because of overselective attention than children of typical development. These findings suggest that a critical distinction between individuals with developmental disabilities and children of typical development may lie in the efficiency with which prior reinforcement histories determine how they

attend to complex stimuli. Indeed, the consistency with which students respond to compounds with conflicting prior reinforcement histories may prove to be effective for identifying students with developmental disabilities and attentional deficits.

An online version of the stimulus-control procedure was also developed in this study, which was successful in assessing the visual attention of participants differing in age. This demonstrated, as a result, the feasibility of providing visual attention assessments online for both identifying and eliminating visual attention impairments in both children and individuals with developmental disabilities. Because of the rapid increase in children diagnosed with autism, it has become increasingly difficult to provide the adequate amount of behavioral interventions to address these issues. Online programs, which are fully automated, such as the procedures described in this study, could be provided in the home with parental supervision to increase the amount of weekly instruction provided. They could also be administered at a young age to both identify visual impairments and improve visual attention, which is critical in enhancing later development.

(Presentation slides follow)

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Groton, MA
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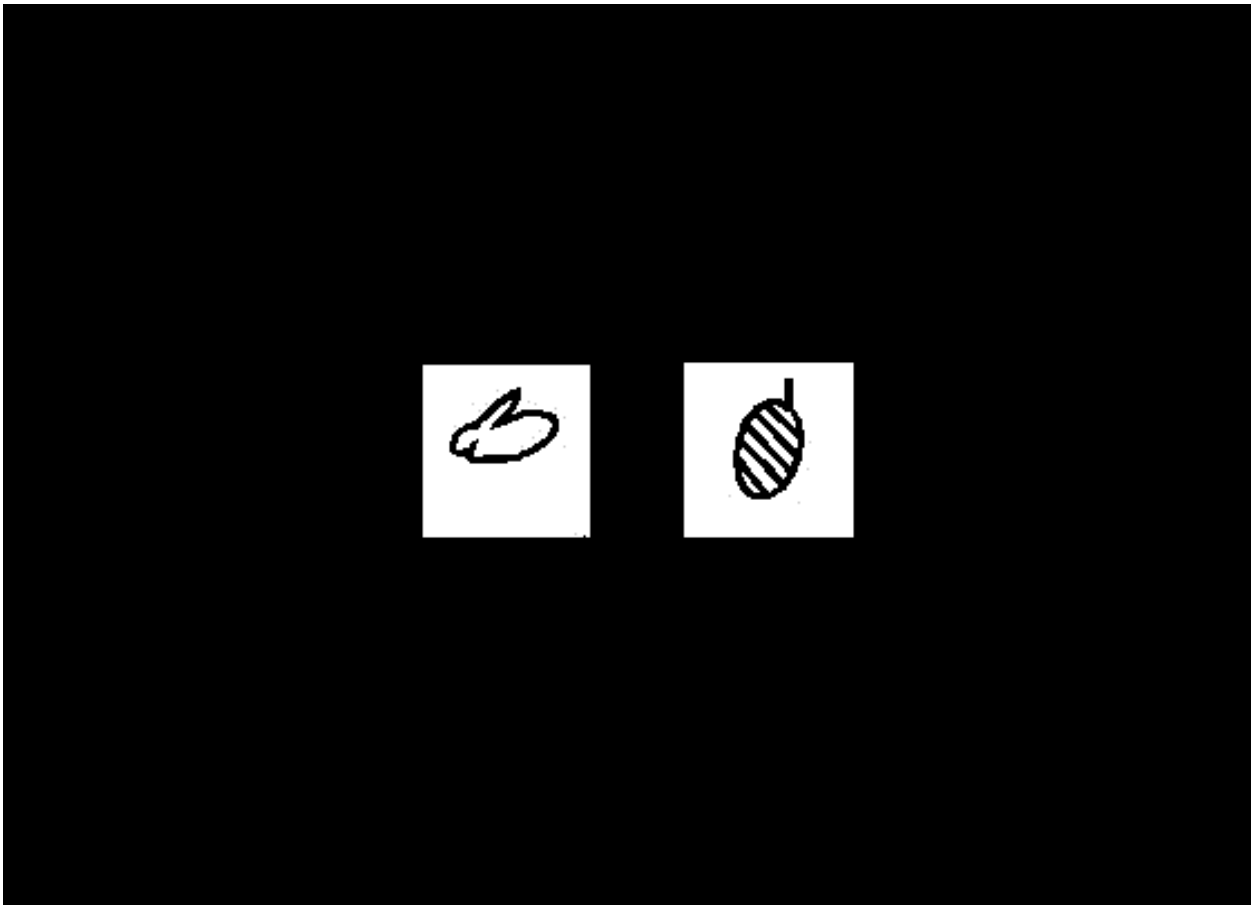
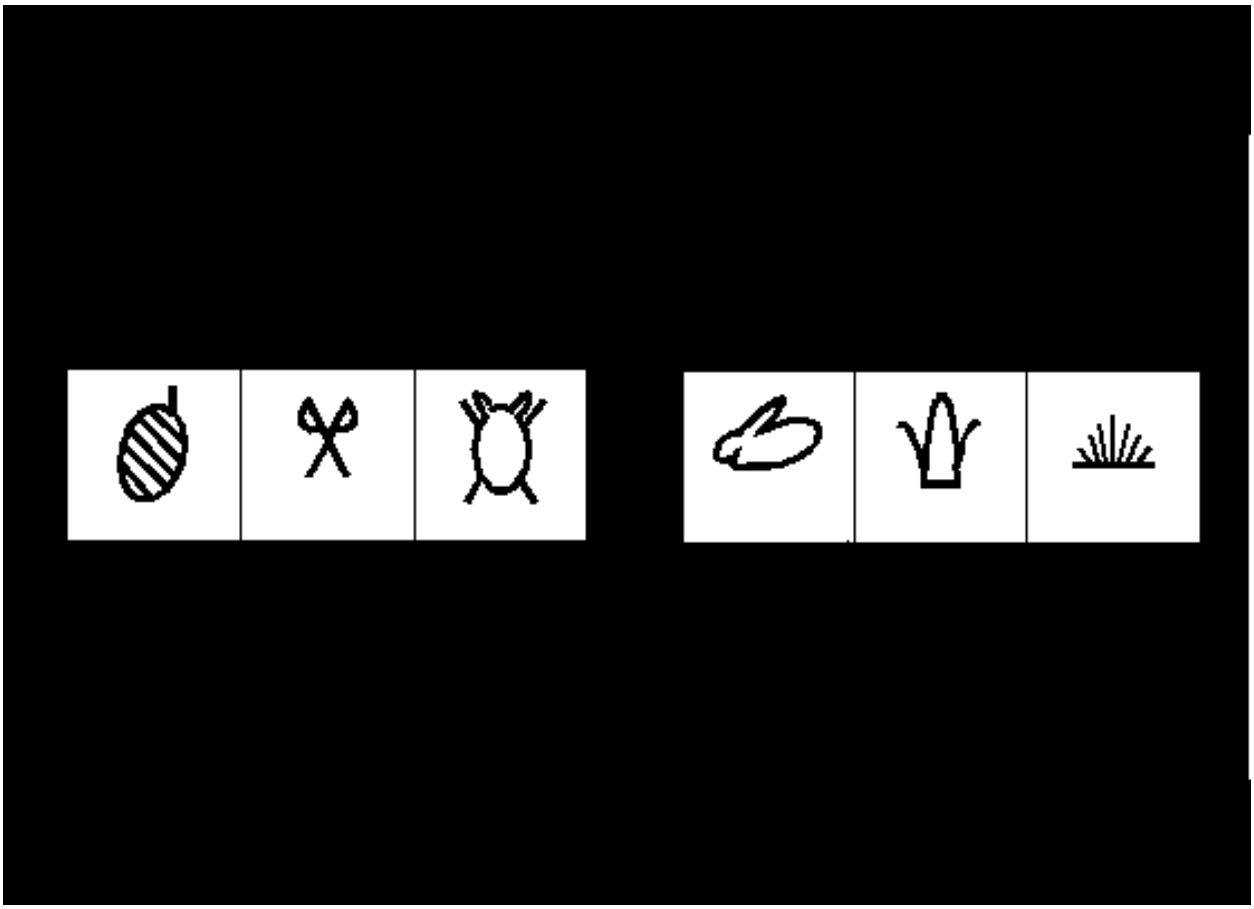
Single Symbol Training



Single Symbol Training

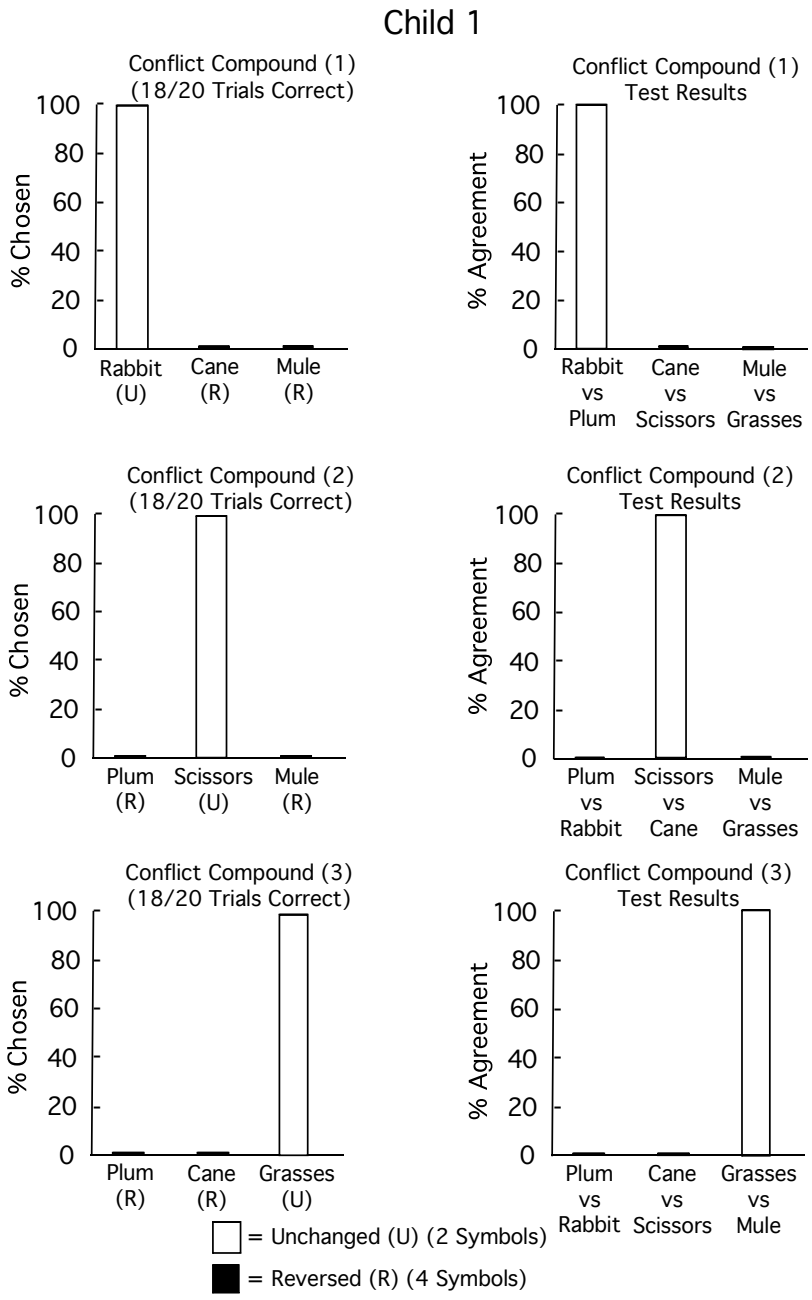
(+)	(-)
Rabbit	Plum
Scissors	Cane
Grasses	Mule

Conflict Compound

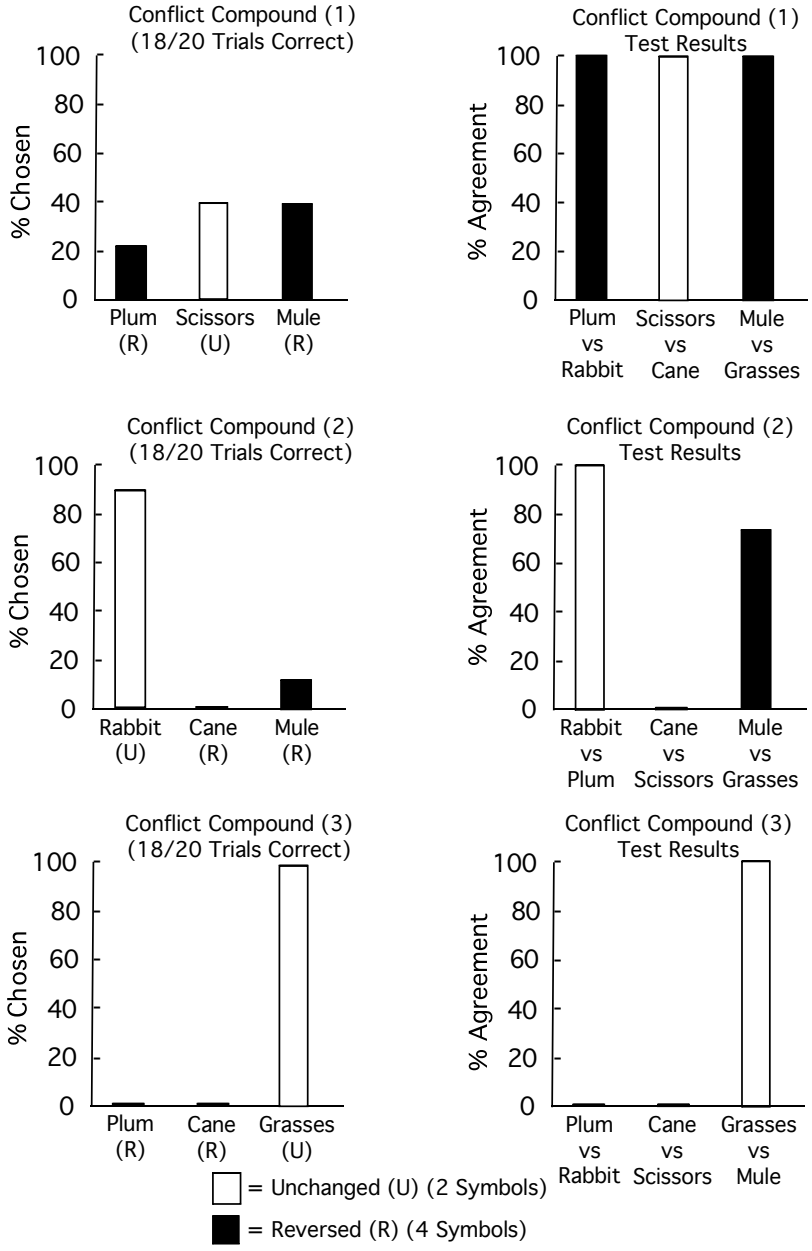


Conflict Compounds

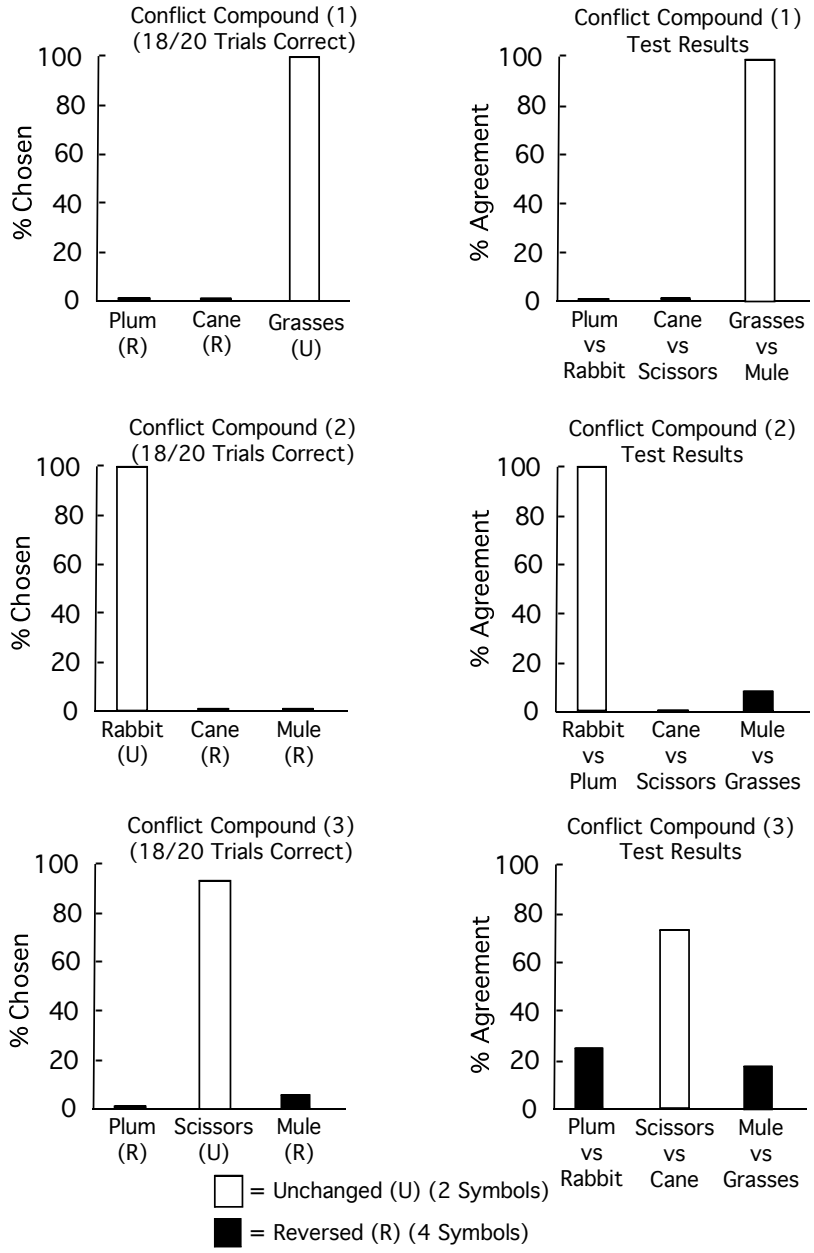
(+)			(-)		
Plum (R)	Scissors (U)	Mule (R)	Rabbit (R)	Cane (U)	Grasses (R)
Rabbit (U)	Cane (R)	Mule (R)	Plum (U)	Scissors (R)	Grasses (R)
Plum (R)	Cane (R)	Grasses (U)	Rabbit (R)	Scissors (R)	Mule (U)

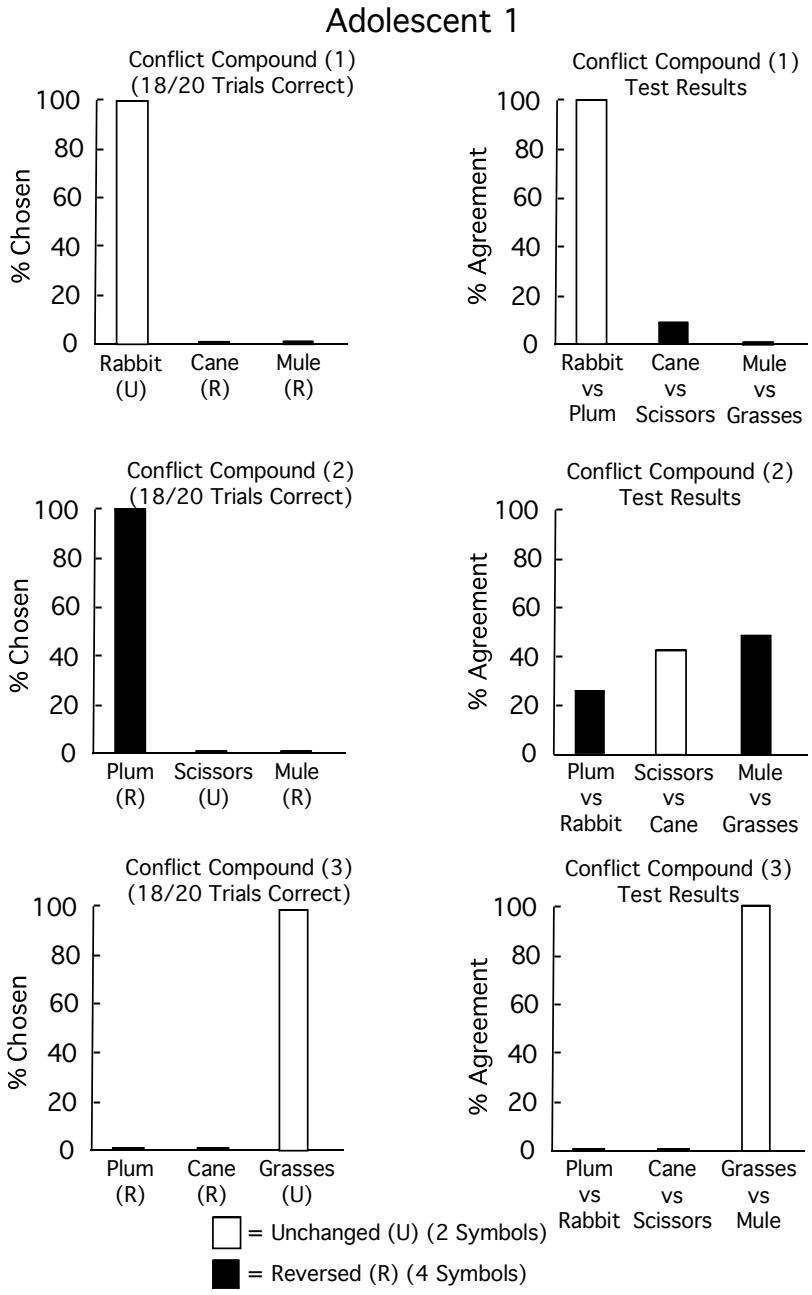

Child 1
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (1)
Test Results
% Agreement
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (2)
(18/20 Trials Correct)
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (2)
Test Results
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

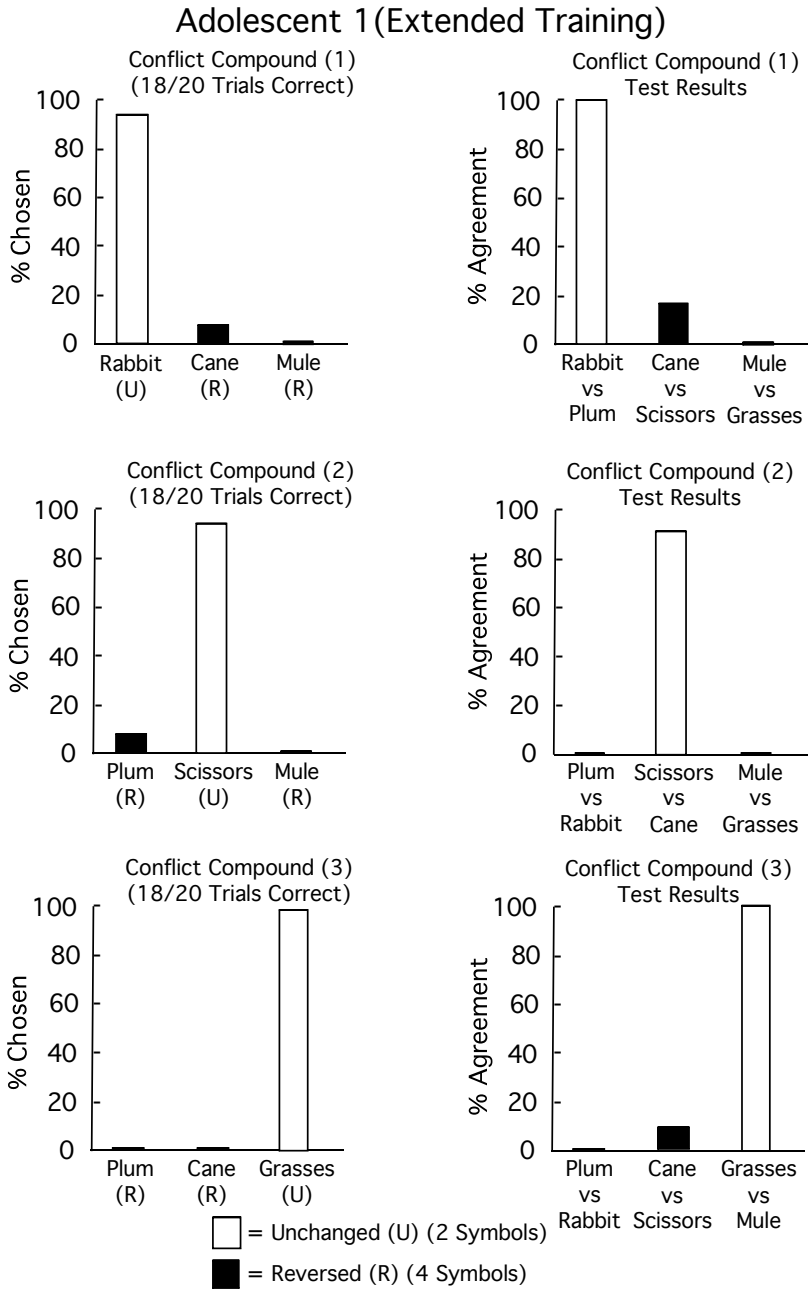
Child 2

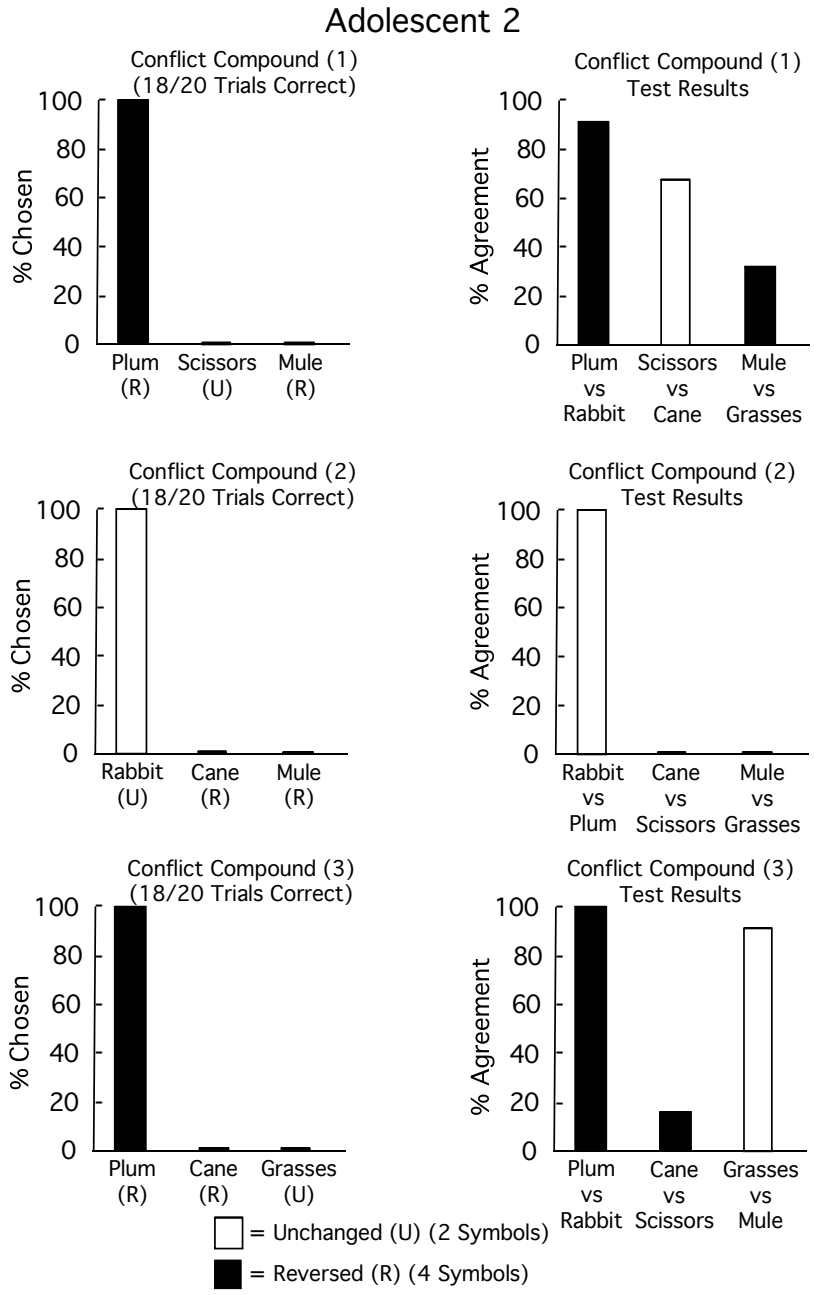

Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (1)
Test Results
% Agreement
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (2)
(18/20 Trials Correct)
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (2)
Test Results
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

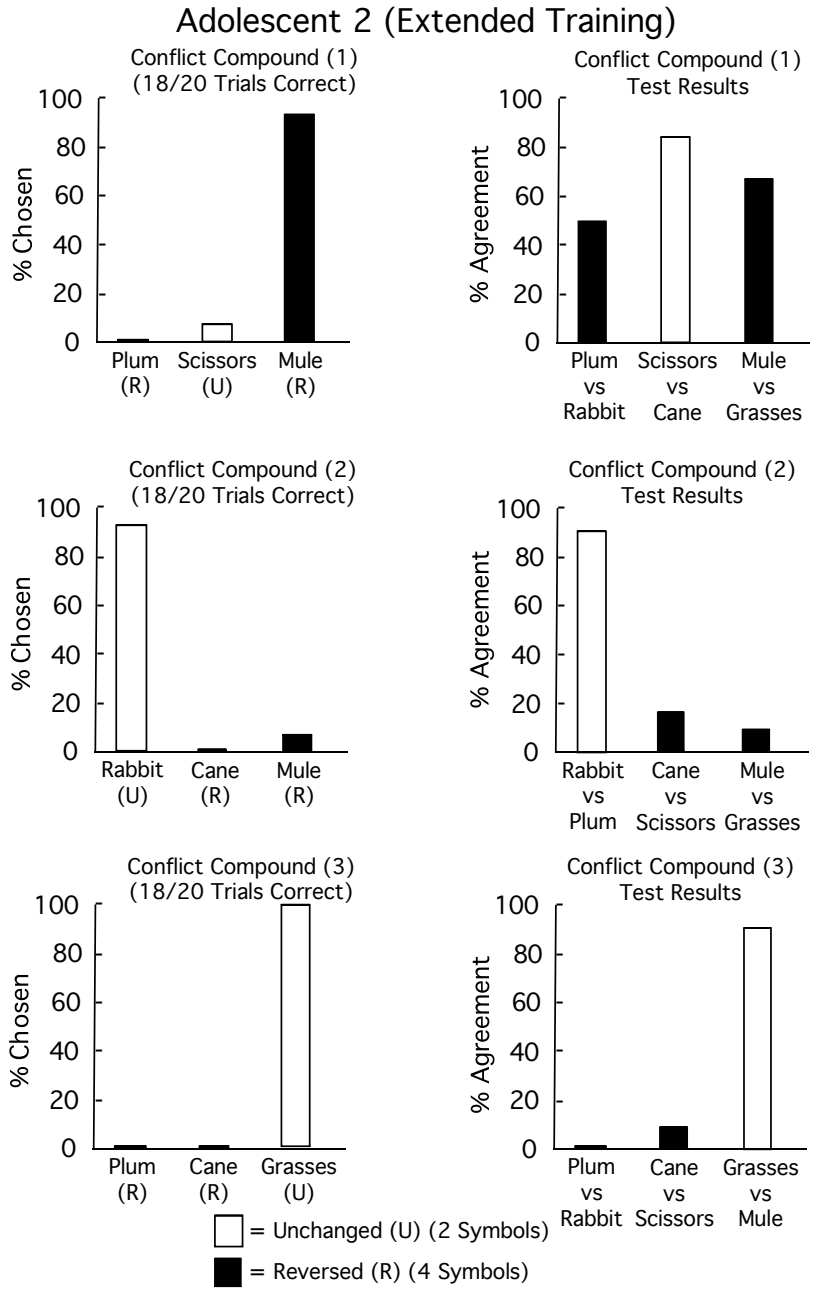
Child 3

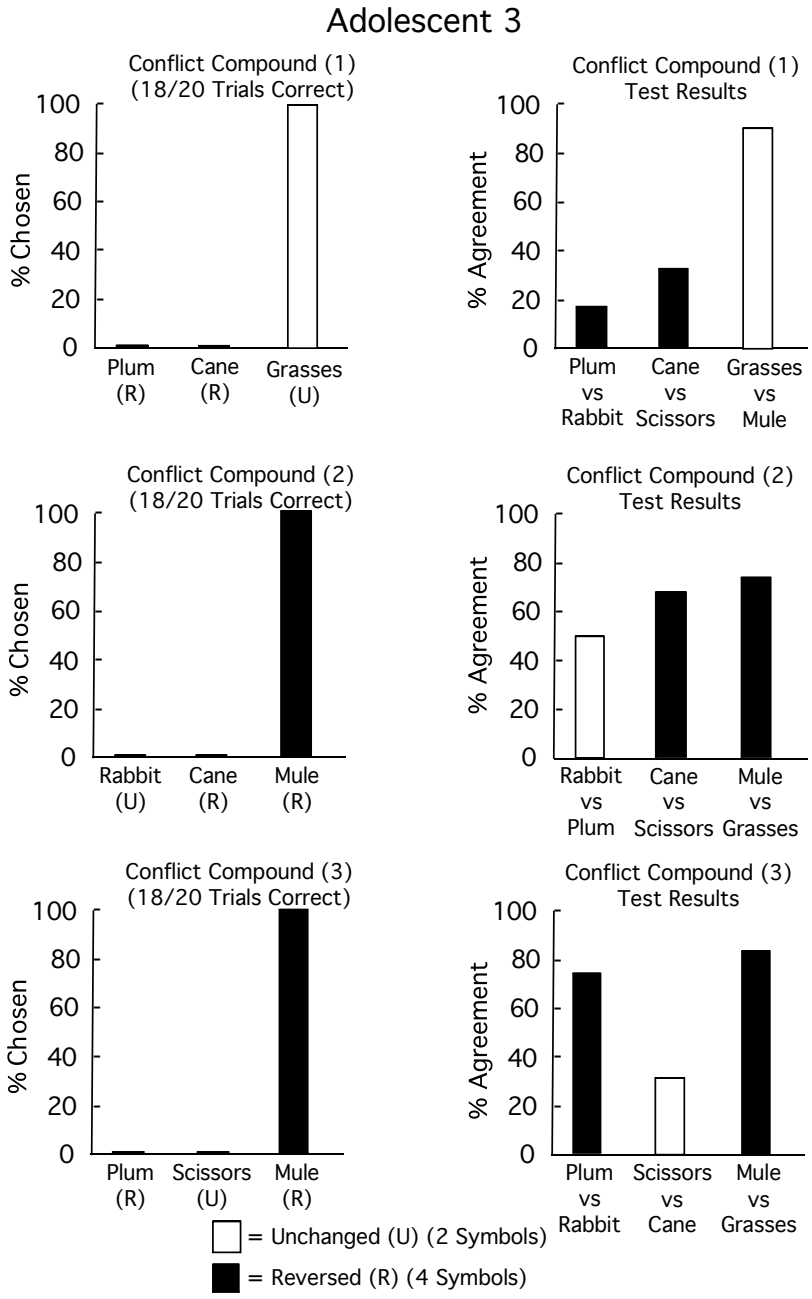

Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (1)
Test Results
% Agreement
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
Conflict Compound (2)
(18/20 Trials Correct)
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (2)
Test Results
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

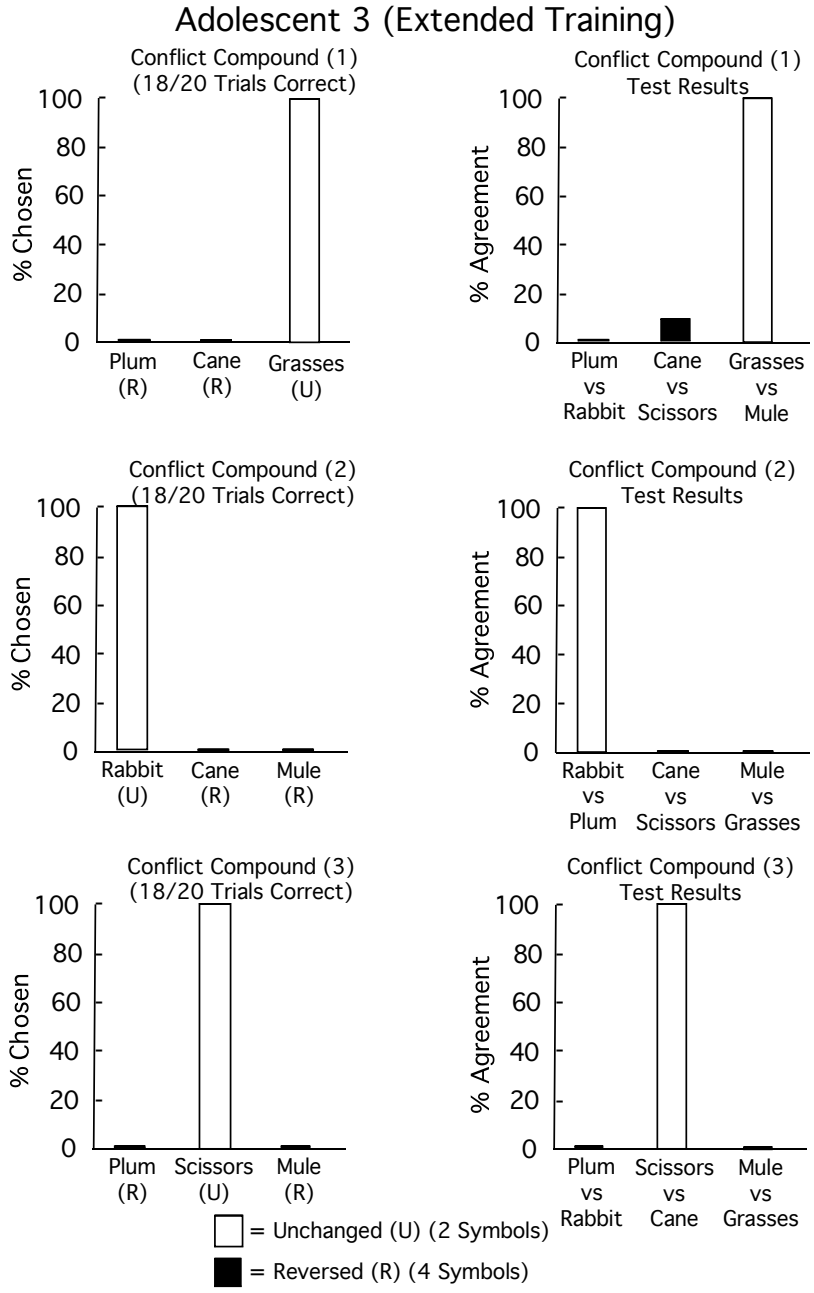

Adolescent 1
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (1)
Test Results
% Agreement
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (2)
(18/20 Trials Correct)
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (2)
Test Results
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)


Adolescent 1 (Extended Training)
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (1)
Test Results
% Agreement
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (2)
(18/20 Trials Correct)
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (2)
Test Results
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

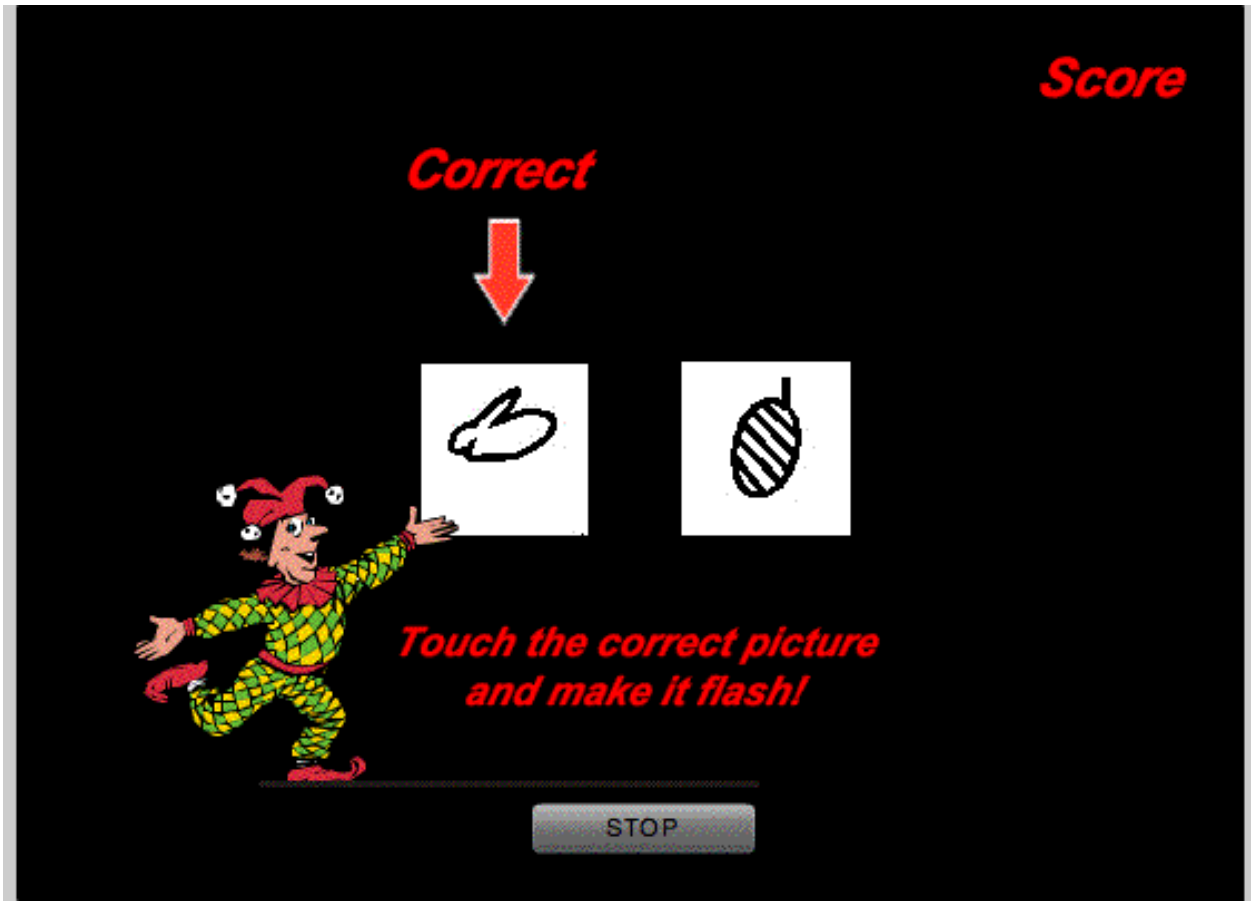

Adolescent 2
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (1)
Test Results
% Agreement
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (2)
(18/20 Trials Correct)
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (2)
Test Results
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)


Adolescent 2 (Extended Training)
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (1)
Test Results
% Agreement
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (2)
(18/20 Trials Correct)
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (2)
Test Results
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

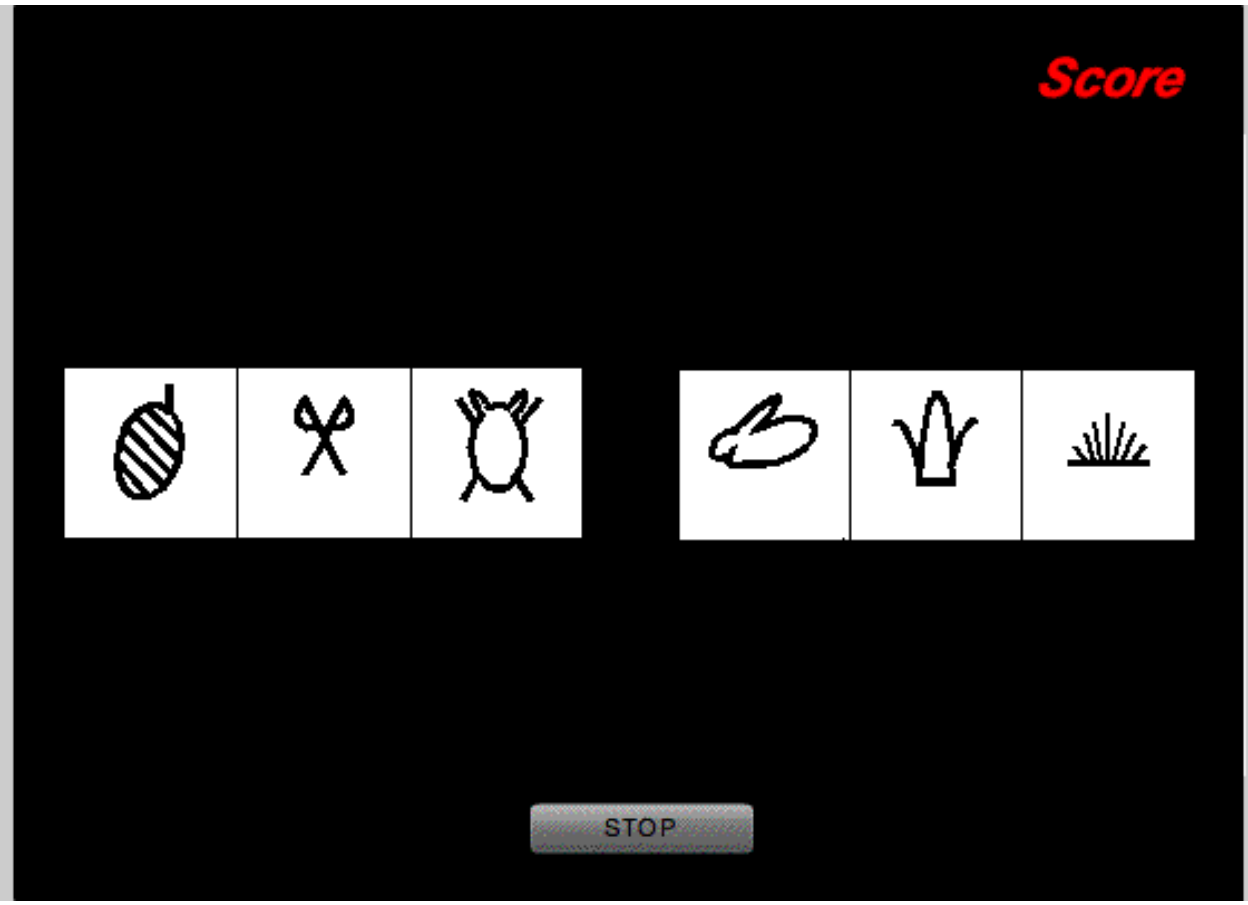

Adolescent 3
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (1)
Test Results
% Agreement
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
Conflict Compound (2)
(18/20 Trials Correct)
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (2)
Test Results
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

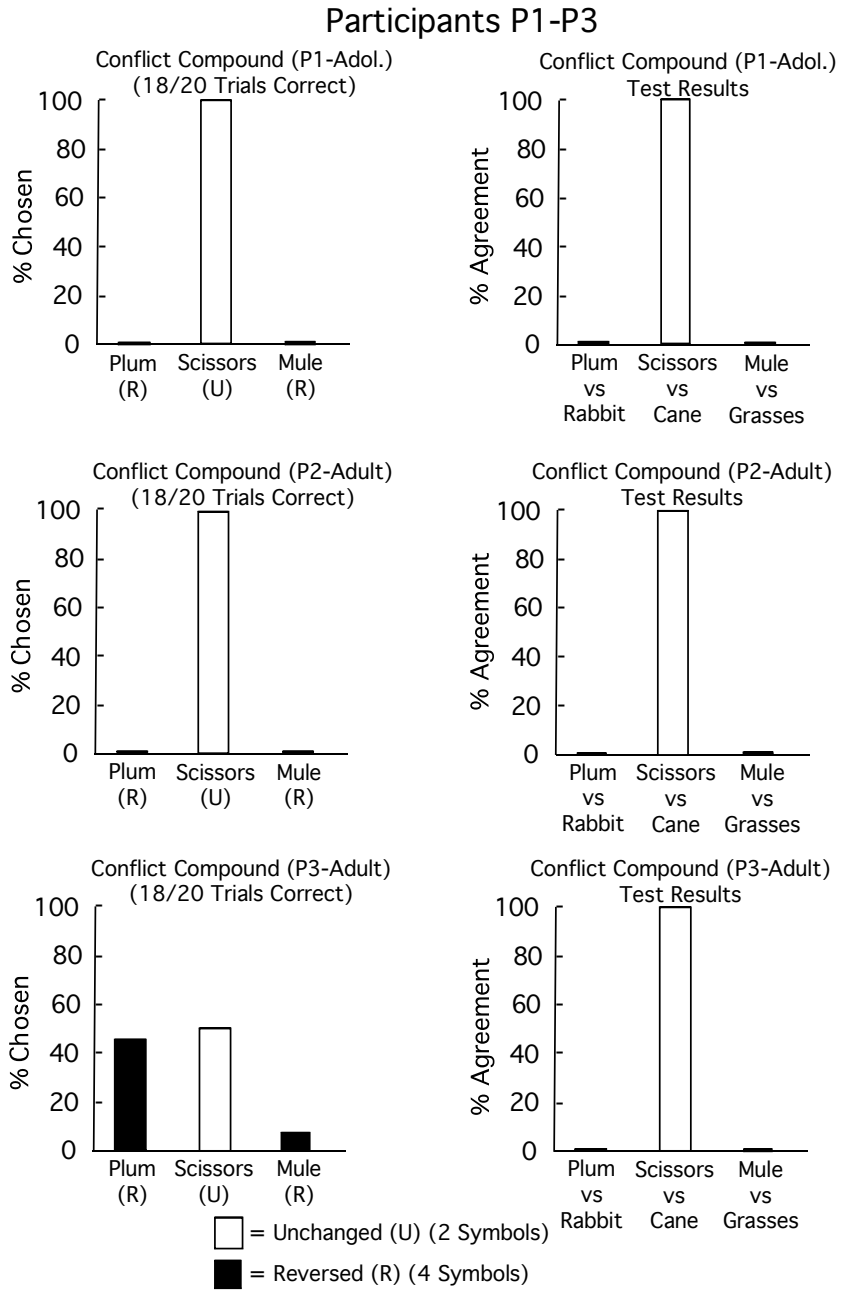

Adolescent 3 (Extended Training)
Conflict Compound (1)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Cane (R)
Grasses (U)
Conflict Compound (1)
Test Results
% Agreement
Plum vs Rabbit
Cane vs Scissors
Grasses vs Mule
Conflict Compound (2)
(18/20 Trials Correct)
Rabbit (U)
Cane (R)
Mule (R)
Conflict Compound (2)
Test Results
Rabbit vs Plum
Cane vs Scissors
Mule vs Grasses
Conflict Compound (3)
(18/20 Trials Correct)
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (3)
Test Results
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)

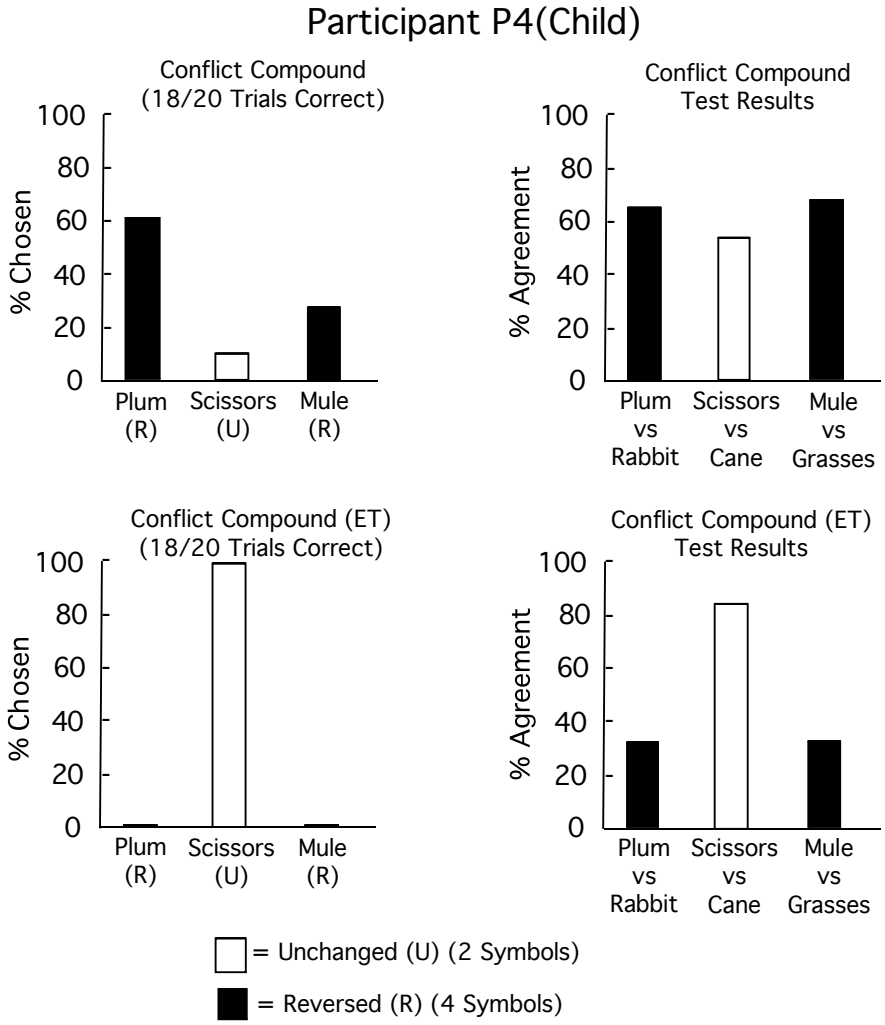
Online Single Symbol Training



Online Conflict Compound




Participants P1-P3
Conflict Compound (P1-Adol.)
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound (P1-Adol.)
Test Results
% Agreement
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (P2-Adult)
(18/20 Trials Correct)
Conflict Compound (P2-Adult)
Test Results
Conflict Compound (P3-Adult)
(18/20 Trials Correct)
Conflict Compound (P3-Adult)
Test Results
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)


Participant P4(Child)
Conflict Compound
(18/20 Trials Correct)
% Chosen
100
80
60
40
20
0
Plum (R)
Scissors (U)
Mule (R)
Conflict Compound
Test Results
% Agreement
Plum vs Rabbit
Scissors vs Cane
Mule vs Grasses
Conflict Compound (ET)
(18/20 Trials Correct)
Conflict Compound (ET)
Test Results
= Unchanged (U) (2 Symbols)
= Reversed (R) (4 Symbols)